ClimaDry Modulating Reheat Option Submittal Data

English Language/I-P Units

Rev.: 1 February, 2008D

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SUBMITTAL DATA

Unit Designation: _____

Job Name: _____

Architect: _____

Engineer: _____

Contractor: _____

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Example of TS Series Nomenclature With ClimaDry Option

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
T	S	V	0	7	0	A	G	D	3	0	D	L	T	S

Voltage
G = 208-230/60/1
E = 265/60/1
H = 208-230/60/3
F = 460/60/3

Heat Exchanger Options

	Non Coated Air Coil		Coated Air Coil	
	Copper	Cupro-Nickel	Copper	Cupro-Nickel
ClimaDry Reheat	E	N/A	D	N/A

Controls

Control	w/o Disconnect	w/ Disconnect
DXM	D	B
DXM w/LON	M	K
DXM w/MPC	P	S

Water Circuit Options
0 = None
2 = HWG (Coil Only)
5 = Secondary Circulating Pump

Rev.: 30 Jan, 2008D

CAUTION:
Water Source Heat Pump systems (including Water Loop Heat Pump systems) must have antifreeze protection to 20°F [-6.7°C] for ClimaDry applications. The ClimaDry option MUST NOT be used on open water loop systems, or any system without antifreeze protection.

Notes:

1. ClimaDry reheat option must be ordered with original equipment (cannot be field added). Unit must have DXM control. Not available for units with internal water valve, flow regulator options, or 575Volt. Check unit submittal for limitations and specific requirements.
2. ClimaDry cannot be used on open loop systems, only closed loop systems.
3. ClimaDry systems must use appropriate antifreeze solutions.
4. ClimaDry is not recommended for applications with poor water quality (see water quality guidelines in unit IOM). The copper heat exchanger with cast iron pump (standard ClimaDry option) are designed for closed loop systems.
5. Max working water pressure for the ClimaDry option is 145psig.
6. Available with TT, TS, GS, GCV, GLV models (see Table 1). Check unit submittal data nomenclature for models with ClimaDry reheat option.
7. Thermostat must be either:
   1. Thermostat with dehumidification mode (similar to ATA32U02)
   2. Thermostat and separate humidistat or dehumidistat controller (see Table 3 for DXM DIP settings).
8. ClimaDry units must have minimum entering air temperature of 70°F DB / 61°F WB

Table 1: ClimaDry Availability

Model	Configuration	Yes	No
GC	Vertical	X	
	Horizontal		X
GS	Vertical	X	
	Horizontal	X	
TT	Vertical	X	
	Horizontal	X	
TS	Vertical	X	
	Horizontal	X	
GL	Vertical	X	
	Horizontal		X

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CLIMADRY MODULATING REHEAT OPTION

ClimateMaster's ClimaDry Dehumidification option (patent pending) is an innovative means of providing modulating reheat without the complication of refrigeration controls. ClimaDry is Hot Gas Generated Reheat, which utilizes one of the biggest advantages of a Water-Source Heat Pump (WSHP), the transfer of energy through the water piping system. ClimaDry simply diverts condenser water through a water-to-air coil that is placed after the evaporator coil. If condenser water is not warm enough, the internal "run-around" loop increases the water temperature with each pass through the condenser coil (see figure 1, below).

ClimaDry Benefits

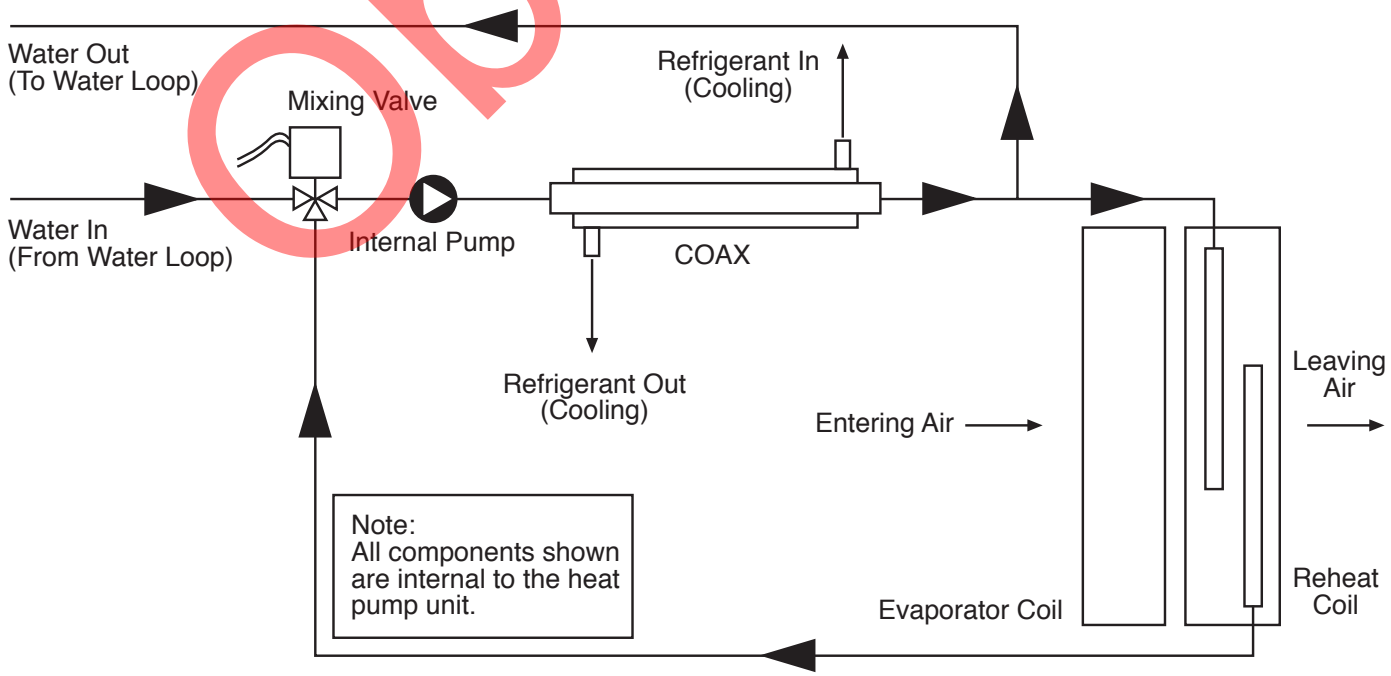
ClimaDry is like no other reheat option on the market. Proportional reheat is controlled to the desired leaving air temperature set point (factory set point of 72°F, 22°C), no matter what the water loop temperature is. Since dehumidification operation will occur under less than full load cooling conditions a good percentage of the time, it is important to have a reheat function that provides 100% reheat in the spring and fall when the water loop is cool. Supply air temperature is field adjustable to +/- 3°F [+/- 1.7°C] for even greater flexibility with the optional potentiometer. Competitors without ClimaDry typically use an on/off (non-modulating) refrigeration based reheat circuit, typically referred to as "Hot gas reheat" (HGR). HGR needs higher condensing temperatures to work well, typically 85°F [29°C] entering water temperature (EWT). With HGR, cooler water temperatures produce cooler supply air temperatures, which could overcool the space, requiring additional space heating from another source or a special auto-change-over relay to allow the unit to switch back and forth between reheat and heating. Rarely does HGR provide 100% reheat, like ClimaDry. ClimaDry has a simple and easy to troubleshoot refrigerant circuit. No switching valves or hard to diagnose leaky check valves are utilized. No unusual refrigerant pressures occur during the reheat mode. The ClimaDry refrigerant circuit is like every other ClimateMaster unit (without reheat), so everything the technician already knows applies to troubleshooting the ClimaDry refrigeration circuit. Plus, the water loop portion of the ClimaDry option is easy to understand and diagnose.

ClimaDry Applications

ClimaDry can be applied to a number of common applications, such as . . .

- Classrooms.
- Condominiums.
- Apartments.
- Computer rooms.
- Spaces with high latent loads like auditoriums, theaters, convention centers, etc.
- Anywhere humidity is a problem.

Figure 1: ClimaDry Schematic



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With the ClimaDry option, return air from the space is conditioned by the air-to-refrigerant (evaporator) coil, and then reheated by the water-to-air (reheat) coil to dehumidify the air, but maintain the same space temperature (thus operating as a dehumidifier). The moisture removal capability of the heat pump is determined by the unit's latent capacity rating. Latent capacity equals Total capacity minus Sensible capacity. For example, at 85°F [29°C] EWT, the moisture removal capability (latent capacity) of a ClimateMaster GC036 is 9.6 Mbtuh [2.8kW] as shown in figure 2.

Dividing the latent capacity by 1,069 BTU/LB of water vapor at 80°F DB and 67°F WB [26.7°C DB and 19.4°C WB] moist air enthalpy, converts the amount of moisture removal to pounds per hour (multiply pounds per hour by 0.4536 to obtain kg/hr). Calculations are shown in figure 2. Most ClimateMaster heat pumps have a sensible-to-total (S/T) ratio of 0.72 to 0.76. Therefore, approximately, 25% of the cooling capacity is dedicated to latent cooling capacity (moisture removal). When selecting a unit with ClimaDry, the space sensible and latent loads should be calculated. If the unit will be used for space cooling, a unit with at least enough capacity to satisfy the building sensible load should be selected. If the latent cooling load is not satisfied by the selection, a larger unit with enough latent capacity will be required. If the unit will be used for dehumidification purposes only, the latent capacity is the only consideration necessary. In this case, sensible load is immaterial. Example latent capacities for the GC series are shown in table 2.

Table 2: Example GC Latent capacity

GC Series Latent Capacity at 85°F [29.4°C] EWT				
Size	MBtuh	lbs/hr	kW	kg/hr
18	4.7	4.4	1.4	2.0
24	6.1	5.7	1.8	2.6
30	6.8	6.4	2.0	2.9
36	9.6	9.0	2.8	4.1
41	9.7	9.1	2.8	4.1
42	11.0	10.3	3.2	4.7
48	12.7	11.9	3.7	5.4
60	15.2	14.2	4.5	6.4

Figure 2: Example GCV036 Performance

PERFORMANCE DATA
GCH/V 036B

LC = TC - SC = 35.6 - 26.0 = 9.6 MBtuh
9600 Btuh ÷ 1069 = 8.9 lbs/hr (4.0 kg/hr)

1200 CFM Nominal Airflow

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		COOLING - EAT 80/67 °F						HEATING - EAT 70 °F				
		PSI	FT	TC	SC	Sens/Tot Ratio	KW	HR	EER	HC	KW	HE	LAT	COP
60	4.5	1.8	4.1	38.2	26.8	0.70	2.74	47.6	14.0	39.0	2.94	28.9	100.1	3.88
	6.8	3.2	7.4	39.0	26.9	0.69	2.58	47.8	15.1	41.4	3.03	31.0	101.9	4.00
	9.0	5.1	11.8	39.3	27.1	0.69	2.50	47.8	15.7	42.6	3.07	32.1	102.9	4.06
†70	4.5	1.7	3.9	36.8	26.3	0.72	2.95	46.6	12.4	43.9	3.12	33.3	103.9	4.12
	6.8	3.1	7.2	37.8	26.7	0.71	2.80	47.3	13.5	46.2	3.21	35.2	105.6	4.22
	9.0	**4.9**	**11.3**	38.3	26.8	0.70	2.72	47.6	14.1	**47.2**	**3.25**	**36.1**	**106.4**	**4.26**
80	4.5	1.7	3.8	34.4	25.6	0.74	3.15	45.1	10.9	47.9	3.28	36.7	107.0	4.28
	6.8	3.0	7.0	35.9	26.2	0.73	3.01	46.2	11.9	49.7	3.36	38.2	108.3	4.34
	9.0	4.8	11.0	36.7	26.4	0.72	2.94	46.7	12.5	50.5	3.40	38.9	108.9	4.35
†85	4.5	1.6	3.8	33.1	25.0	0.76	3.24	44.1	10.2	49.5	3.35	38.1	108.2	4.33
	6.8	3.0	6.9	34.8	25.8	0.74	3.11	45.4	11.2	50.9	3.42	39.3	109.3	4.36
	9.0	**4.7**	**10.9**	**35.6**	**26.0**	**0.73**	**3.05**	**46.0**	**11.7**	51.5	3.45	39.7	109.7	4.37
90	4.5	1.6	3.7	31.6	24.3	0.77	3.34	43.0	9.5	50.8	3.41	39.1	109.2	4.36
	6.8	2.9	6.8	33.5	25.2	0.75	3.21	44.5	10.4	51.8	3.47	39.9	110.0	4.37
	9.0	4.6	10.7	34.4	25.6	0.74	3.15	45.1	10.9	52.1	3.50	40.2	110.2	4.36
95	4.5	1.6	3.7	30.1	23.5	0.78	3.43	41.8	8.8					
	6.8	2.9	6.7	32.0	24.6	0.77	3.31	43.3	9.7	Operation Not Recommended				
	9.0	4.6	10.6	33.0	25.0	0.76	3.25	44.1	10.2					

Note: Minimum entering air temperature of 70°F DB / 61°F WB

Dividing the latent capacity by 1,069 BTU/LB of water vapor at 80°F DB and 67°F WB [26.7°C DB and 19.4°C WB] moist air enthalpy, converts the amount of moisture removal to pounds per hour (multiply pounds per hour by 0.4536 to obtain kg/hr). Calculations are shown in figure 2.

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ClimaDry Sequence of Operation

A heat pump equipped with ClimaDry can operate in three modes; cooling, cooling with reheat, and heating. The cooling/heating modes are like any other ClimateMaster WSHP. The reversing valve ("O" signal) is energized in cooling, along with the compressor contactor(s) and blower relay. In the heating mode the reversing valve is de-energized. Almost any thermostat will activate the heat pump in heating or cooling modes. The DXM microprocessor board, which is standard with the ClimaDry option, will accept either heat pump (Y,O) thermostats or non-heat pump (Y,W) thermostats.

The reheat mode requires a either a separate humidistat/ dehumidistat or a thermostat that has an integrated dehumidification function for activation. The DXM board is configured to work with either a humidistat or dehumidistat input to terminal "H" (DIP switch settings for the DXM board are shown below in table 3). Upon receiving an "H" input, the DXM board will activate the cooling mode and engage reheat. Table 4 shows the relationship between thermostat input signals and unit operation.

There are four operational inputs for single stage units and six operational inputs for dual stage units:

-Fan Only
-1st Stage Cooling
-2nd Stage Cooling
-1st Stage Heating
-2nd Stage Heating
-Reheat Mode

- Fan Only: A (G) call from the thermostat to the (G) terminal of the DXM control board will bring the unit on in fan only mode.
- 1st Stage Cooling: A simultaneous call from (G), (Y1), and (O) to the (G), (Y1), (O/W2) terminals of the DXM control board will bring the unit on in 1st Stage Cooling.
- 2nd Stage Cooling: A simultaneous call from (G), (Y1), (Y2), and (O) to the (G), (Y1), (Y2), and (O/W2) terminals of the DXM control board will bring the unit on in 2nd Stage Cooling. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Cooling until the 1st Stage Cooling call is

Table 3: Humidistat/Dehumidistat Logic and DXM (2.1, 2.2., 2.3) DIP settings

Sensor	2.1	2.2	2.3	Logic	Reheat (ON) - H	Reheat (OFF) - H
Humidistat	OFF	OFF	OFF	Reverse	0 VAC	24 VAC
Dehumidistat	OFF	ON	OFF	Standard	24 VAC	0 VAC

Table 4: ClimaDry Operating Modes

Mode	Input					Output				
	O	G	Y1	Y2[3]	H	O	G	Y1	Y2[3]	Reheat
No Demand	ON/OFF	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF	OFF	OFF
Fan Only	ON/OFF	ON	OFF	OFF	OFF	ON/OFF	ON	OFF	OFF	OFF
Cooling 1st Stage	ON	ON	ON	OFF	OFF	ON	ON	ON	OFF	OFF
Cooling 2nd Stage	ON	ON	ON	ON	OFF	ON	ON	ON	ON	OFF
Cooling & Dehumidistat[1]	ON	ON	ON	ON/OFF	ON	ON	ON	ON	ON/OFF	OFF
Dehumidistat Only	ON/OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON
Heating 1st Stage	OFF	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF
Heating 2nd Stage	OFF	ON	ON	ON	OFF	OFF	ON	ON	ON	OFF
Heating & Dehumidistat[2]	OFF	ON	ON	ON/OFF	ON	OFF	ON	ON	ON/OFF	OFF

[1]Cooling input takes priority over dehumidify input.
[2]DXM is programmed to ignore the H demand when the unit is in heating mode.
[3]N/A for single stage units; Full load operation for dual capacity units.
[4]ON/OFF = Either ON or OFF.

removed or satisfied, shutting down the unit. NOTE: Not all units have two-stage cooling functionality (e.g. GC series units).
- 1st Stage Heating: A simultaneous call from (G) and (Y1) to the (G) and (Y1) terminals of the DXM control board will bring the unit on in 1st Stage Heating.
- 2nd Stage Heating: A simultaneous call from (G), (Y1), and (Y2) to the (G), (Y1), and (Y2) terminals of the DXM control board will bring the unit on in 2nd Stage Heating. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Heating until the call is removed or satisfied, shutting down the unit. NOTE: Not all units have two-stage heating functionality (e.g. GC series units).
- Reheat Mode: A call from the Humidistat/ Dehumidistat to the (H) terminal of the DXM control board will bring the unit on in Reheat Mode if there is no call for cooling at the thermostat. When the Humidistat/Dehumidification call is removed or satisfied the unit will shut down. NOTE: Cooling always overrides Reheat Mode. In the Cooling mode, the unit cools and dehumidifies. If the cooling thermostat is satisfied but there is still a call for dehumidification, the unit will continue to operate in Reheat Mode.

ClimaDry Component Functions

The ClimaDry option consists of the following components:

- Proportional Controller.
- Supply Air Sensor.
- Motorized Valve.
- Loop Pump.
- Hydronic Coil.

The Proportional Controller operates on 24 VAC power supply and automatically adjusts the water valve based upon the Supply Air Sensor. The Supply Air Sensor senses supply air temperature at the blower inlet providing the input signal necessary for the proportional control to drive the motorized valve during the reheat mode of operation. The Motorized Valve is a proportional actuator/three-way valve combination used to divert the condenser water from the coax to the hydronic reheat coil during the reheat mode of operation. The proportional controller sends a signal to the motorized valve based on the supply air temperature of the supply air sensor.

The Loop Pump circulates condenser water through the hydronic reheat coil during the reheat mode of operation. In this application, the loop pump is only energized during the reheat mode of operation. The Hydronic Coil is utilized during the reheat mode of operation to reheat the air to the setpoint of the proportional controller. Condenser water is diverted by the motorized valve and pumped through the hydronic coil by the loop pump in proportion to the control setpoint. The amount of reheating is dependent on the setpoint and how far from setpoint the supply air temperature is. The factory setpoint is 70–75°F [21-24°C], generally considered "neutral" air.

ClimaDry Application Considerations

The reheat coil adds a small amount of resistance to the air stream. In some cases the high static option may be required for applications with higher static ductwork. Consult the submittal data or the Installation/Operation/ Maintenance (I.O.M.) manual for the specific heat pump to review blower tables.

Unlike most hot gas reheat options, the ClimaDry option will operate over a wide range of EWTs. Special flow regulation (water regulating valve) is not required for low EWT conditions. However, below 55°F [13°C], supply air temperatures cannot be maintained at 72°F [22°C] because the cooling capacity exceeds the reheat coil capacity at low water temperatures. Below 55°F [13°C], essentially all water is diverted to the reheat coil (no heat of rejection to the building loop). Although the ClimaDry option will work fine with low EWTs, overcooling of the space may result with well water systems or on rare occasions with ground loop (geothermal) systems (Note: Extended range units are required for well water and ground loop systems). Since dehumidification is generally only required in cooling, most ground loop systems will not experience overcooling of the supply air temperature. If overcooling of the space is a concern (e.g. computer room well water application), auxiliary heating may be required to maintain space temperature when the unit is operating in the dehumidification mode.

Water-Source Heat Pumps with ClimaDry should not be used as make-up air units. These applications should use equipment specifically designed for make-up air.

CAUTION:
Water Source Heat Pump systems (including Water Loop Heat Pump systems) must have antifreeze protection to 20°F [-6.7°C] for ClimaDry applications. The ClimaDry option MUST NOT be used on open water loop systems, or any system without antifreeze protection.

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Submittal Change Log

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